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ure of a mayfly nymph (from Parker & Haswell) on page 399; also the confusion of the lettering in figure 32 on page 79 (from Bessey), and the use of the word ovary with very different meaning in this figure and in one on page 244.

Biological pickles do not seem, as a rule, to excite much enthusiasm on the part of a beginner of high-school age and exception may be taken, therefore, to the suggestion on page 389 that for practise with insects "a mixed lot preserved in wood alcohol or formalin is best." But, as a rule, the suggestions as to laboratory methods are excellent and the book, as a whole, is a valuable contribution to the literature of biological laboratory methods.

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THE SO-CALLED AEROSTATIC HAIRS OF CERTAIN LEPIDOPTEROUS LARVÆ

In his valuable report on the dispersion of the gipsy moth,¹ Mr. A. F. Burgess emphasizes the very great rôle which is played by the wind in distributing the first-stage caterpillars. In this connection he calls attention to, and figures the so-called aerostatic hairs arising from tubercles in first-stage larvæ of the gipsy moth, though he does not commit himself to the theory that they, with their globular swelling at the base, actually aid in making the caterpillars more buoyant.

These peculiar hairs, to be found on first-stage larvæ of the nun moth, as well as of the gipsy moth, were first described by Wachtl and Kornauth² under the name of aerostatic setæ, while they designated the balloon-shaped swellings as aerophores. They have been subsequently noted by several workers.

As indicated by the name, the aerophore was supposed to be filled with air, and Wachtl and Kornauth believed that the aero-

¹ Bull. 119, Bu. Ent., U. S. Dept. Agric., February, 1913.

² Wachtl, F. A., und Kornauth, K., "Beiträge zur Kenntniss der Morphologie, Biologie und Pathologie der Nonne (*Psilura monacha*)," Mittellungen aus dem forstlichen Versuchsvesen Österreichs, XVI., pp. 1-38, 1893, 3 pls.

static bristles presented a collection of balloons which function as an aeronautic apparatus. If their interpretation be correct, it is obvious that in both the nun moth larvæ and in the gipsy moth larvæ these structures play a very important rôle in aiding the dispersal of the species by the wind.

Those who hold to the view that the swellings are in reality aerophores have not sought to explain how it is that the almost microscopic structures should serve as "balloons" if they are filled with air. A balloon rises because it is filled with gas lighter than air. To be sure, Fernald³ suggests that they are distended with air "or gas," but it is difficult to conceive of a possible source of a special gas.

Apparently, Professor Cholodkovsky was the first to suggest the true nature of the so-called aerostatic hairs. First, in a Russian forestry journal and then in Tubeuf's *Zeitschrift*⁴ he called attention to certain serious objections to Wachtl and Kornauth's hypothesis. The fact that the swellings, or vesicles, shrink in dead larvæ, militates against the view that they are filled with air. On the contrary, it favors the view that they contain a fluid which, after the death of the larvæ, naturally must dry up. In larvæ preserved in alcohol, air-filled organs would soon lose their air content, but these vesicles remain for months as full and rounded as in the living larvæ. If such a preparation is allowed to dry on the slide all of the "aerophores" quickly shrivel.

Cholodkovsky, therefore, suggested that the swellings were not filled with air, but with a fluid, and that very probably this was a poisonous one, since the larvæ, in this stage especially, need protection against insectivorous birds. This view was confirmed by the study of sections, which showed a large, unicellular gland underlying each of the "aerostatic bristles" and opening directly into the cavity.

³ Rept. on the Gypsy Moth, Mass. Board of Agr., 1896, pp. 300-301.

⁴ Cholodkovsky, N., "Ueber die sogenannten Aërophore der Nonnenraupe," *Forstlich-naturwissenschaftliche Zeitschr.*, III., pp. 240-243, 1894.

Subsequently Ingenitzky,⁵ a student of Professor Cholodkovsky's, made a much more detailed study of these glands and distinguished them clearly from the trichogens, the enlarged hypodermal cells which give rise to the hairs.

It seems, then, very clearly established that the so-called aerophores have no function of rendering the larvæ more buoyant, but are really *toxophores*, as Cholodkovsky proposed to call them. The rôle of rendering the larvæ more buoyant may much better be ascribed to the long, thin hairs which, as the Russian observer points out, have an unmistakable resemblance to the pappus of some plant seeds.

W. M. A. RILEY

SPECIAL ARTICLES

IS THE BIENNIAL HABIT OF *OENOTHERA* RACES CONSTANT IN THEIR NATIVE LOCALITIES?

THE recent article¹ on "Oenothera and Climate," by R. R. Gates, is of particular interest to me since, for the past few years I have had in culture several of the races of *Oenothera "biennis"* from the vicinity of Ithaca, N. Y. Two (possibly three) of these races which are predominantly biennial in character have in culture in their native locality produced annual individuals. In one case (No. 2, *Oenothera nutans*) the seed was planted during March, 1911, and in May the boxes were kept in the garden with one transplanting until June, when they were transplanted in the open garden. From the experiences of the season of 1912, these rosettes of 1911 started in the greenhouse in March were not so far advanced as they would have been had the seed been planted in the open garden in April. Three out of about 50 or 60 came into flower early in September. Rosettes of the intermediate stage were well formed in August but these three individuals did not form the dense rosettes so characteristic of the others in late autumn. Two of these September flowering individuals were potted and taken into the

⁵ Ingenitzky, I., "Zur Kenntniss der Drüsenhaare der Nonnenraupe (*Ocneria monacha*)," *Höræ Soc. Ent. Rossicae*, XXX., pp. 129-134, pl. VIII., Figs. 9-11, 1896.

¹ SCIENCE, N. S., 37: 155, 156, 1912.

greenhouse, where they flowered all winter. In the spring they were removed to the garden and kept in their pots, where they continued to flower until some time in August, thus flowering continuously for eleven months. Another race (No. 1, *Oenothera pycnocarpa*) under the same conditions remained strictly biennial.

In a third race (No. 17) seed was planted directly in the garden in the early spring of 1912. Eight or ten out of about 200, without the formation of rosettes, came into flower in August, matured seed and died. They were strictly annual. The others are now in the rosette stage.

In another race (No. 16), possibly identical with No. 2, the seed was planted directly in the garden on the same day as No. 17. Out of about 300 individuals one did not form a rosette. It came into flower in August, formed seed and died late in September. This individual was annual, but it remains to be seen if it is a mutant from this race, which can not be determined before the rosettes of the other individuals now passing the winter have come into flower.

From my experience in the culture of *Oenotheras*, which is not extensive it is true, I have come to the conclusion that their behavior as to a strict biennial habit even in their native locality may be different under culture either in the garden or greenhouse from what it is in the open under feral conditions. Fully formed rosettes potted in the autumn and taken into the greenhouse, kept there during the winter and removed to the garden in the spring did not form stems nor come into flower any earlier than those which wintered in the garden.

Another feature of considerable interest which has appeared in connection with some of my cultures may be mentioned here, but an account of the more important results are reserved until after another season's experiences. The feature to which I refer is the possibility of certain races of *Oenothera* becoming perennial or of taking on a perennial habit under certain conditions. Several plants of *Oenothera nutans* which matured in